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ABSTRACT

The purpose of this study was to test the predictive efficiency of the Graduate Record Examination Analytical (GRE-A) score when used in combination with other predictors for doctoral candidacy decisions in an educational psychology department. It was hypothesized that the GRE-A would be a more efficient predictor than faculty ratings on a qualifying examination, oral examination, and/or folder ratings. It was also hypothesized that the GRE-A's predictive efficiency would be of a similar magnitude regardless of area of specialization, sex, and ethnicity. Data were gathered across two years from 68 subjects. The hypotheses were not supported to the extent expected. To the extent the GRE-A is used in combination with other predictor variables the hypotheses were affirmed, providing sufficient evidence regarding the utility of the GRE-A as a predictive measure to warrant the continued use of this score in combination with the usual predictive variables. (BW)

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The GRE Analytical Score as a Predictor for Admission to Ph.D. Candidacy: A Two Year Study*

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The Graduate Record Examination (GRE) traditionally has focused on the academic ability domains of verbal (V) and quantitative (Q) aptitude. These two constructs have been both logically and empirically related to academic performance in a variety of fields (Powers & Swinton, 1981; Willingham, 1974, 1976; Wilson, 1979). The GRE was designed to measure these constructs and has been used extensively as a selection tool for admission to graduate education programs. An extensive body of literature supports the notion that the higher are V & Q the more likely one will succeed in academic pursuits.

Preliminary work was undertaken in 1974 to improve the GRE by broadening its definition to include an analytic component. It was believed this broadening would allow potential graduate students to demonstrate their range of analytical or abstract reasoning skills (Altman, Carlson, & Donlon, 1975). These skills were considered to be important attributes for successful graduate study of any kind (Conrad, Trisman, & Miller, 1977). The result was an experimental item set designed to tap recognition of logical relationships, consistency of interrelated statements, inferences from abstract relationships, and the like (Powers & Swinton, 1981). These item sets seem logical in their importance to graduate education in general, and,

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more specifically, they seem to be important attributes of successful Ph.D. level scholars. Powers and Swinton (1981) demonstrated this analytical construct to differ from the GRE aptitude, designed to tap academic potential for graduate study in decisions related to admission to Ph.D. candidacy of qualified students. However, the effectiveness of this attempt to broaden the GRE Aptitude Test definition has yet to be tested in a field setting. This investigation is a step in that direction.

Purpose

This study is a continuation of a previously reported investigation in which the Graduate Record Examination Analytical (GRE-A) score was confirmed as a predictor of admissions to a Ph.D. program (Mowsesian & Hays, 1982). The purpose of this study is to test the predictive efficiency of the GRE-A, when used in combination with other predictors for doctoral candidacy decisions in an Educational Psychology Department. This current study hypothesizes that the GRE-A will be a more efficient predictor for admission to Ph.D. candidacy decisions than faculty ratings on a qualifying examination, oral examination, and/or folder ratings (independent work and student accomplishments) as well as other variables assumed to be important in such decision making. It is also hypothesized that within a complex multipurpose graduate department, the GRE-A's predictive efficiency will be of a similar magnitude regardless of area of specialization, sex, and ethnicity. It was expected that should these hypotheses be supported, psychology-oriented graduate departments would have an efficient predictor more compatible with graduate education for decisions concerning admission

to Ph.D. candidacy, thus reducing faculty time devoted to this task. Such findings hold obvious implications for selection of students for matriculation in the specialized areas of a complex multipurpose graduate department. Finally, the GRE Board Research Committee has recommended increased institutional studies using the GRE (Willingham, 1976). This study hopefully makes a contribution within the spirit of their recommendation and assists in establishing the utility for a more broadly defined GRE.

Methodology

Graduate Record Examination Aptitude Scores, (V,Q,A), sex, ethnicity, area of specialization, and faculty evaluations in a Ph.D. qualification procedure constitute the primary data for this investigation. These data were gathered across two years from 68 subjects who were evaluated for the first time regarding advancement to candidacy decisions. Two data sets gathered warrent explanation since they are not necessarily similar to other graduate educational settings. They are area of specialization and the faculty evaluation system.

Area of Specialization

Students admitted to this graduate program who declare a specialization, with current distribution of the present sample is as follows:

Area I: Learning, Cognition and Motivation (N=5),

Area II: Human Development, which includes Social Psychology and Personality (N=7), Area III: All quantitative areas (N=6), School Psychology (N=22), Counseling Psychology (N=24), and

Academic Educational Psychology (N=4), which is a nondeclared specialization area.

The uneven distribution of subjects by area in this study reflect the professional vs. academic focus, a common characteristic within most large multifacted graduate educational psychology departments.

Faculty Evaluation

The subjects undergo a three stage evaluation procedure during which a sub-group of the graduate faculty render three separate evaluations and then make an overall recommendation concerning the subject's level of readiness for advancement to Ph.D. candidacy. These evaluations include:

1. A written sample which involves a research proposal (R.P.) on a topic of the student's own choice. The student is expected to include a display of relevant knowledge encompassing the three academic areas described above.
2. A folder evaluation includes all information, transcripts, letters, etc. generally found in a cumulative file as well as papers, articles, and the like which students are encouraged to include.
3. Evaluated on an oral examination associated with the student's primary written requirement.

Thus, there are three sets of evaluations from one set of three faculty members representing each of the three academic areas. It is from this evaluation procedure that the three faculty members form the bases for an overall recommendation to the Graduate Studies Committee (GSC)

composed of the department's full graduate faculty. The GSC makes a final recommendation to the Graduate School regarding the student's readiness for candidacy based upon their collective wisdom. The GSC may accept the subcommittee's recommendation or reject it and recommend an alternative.

Two possible limitations for this investigation should be noted here. First, sample size (N=68) may be perceived as small from one perspective. A larger N would certainly increase the power of our conclusions and suggest more confident generalizations. However, most Ph.D. programs in Educational Psychology do not evaluate as large a pool of candidates during any one year as is the case here (N=34 average per year in this sample). These subjects do represent a broad cross-section of the United States as well as foreign countries which may suggest that a cross-national as well as a cross-cultural influence may be operating. Most graduate programs strive for geographical hetrogenity similar to this sample. Finally, institutional studies such as those urged by the GRE Board Research Committee (Willingham, 1976) will, by their vary nature, be comprised of small N's. For these reasons, the sample size is felt to be reasonable and representative of a multifaceted educational psychology department, and, one that does allow us to test our hypotheses with a reasonable level of confidence, at least in education psychology departments similar to this.

A second limitation has to do with the status an relevancy of the GRE-A as presently constituted. The results of this investigation are predicated upon use of an experimental set of items which comprise the GRE-A score. The subjects in this study were admitted to this program during the fall semesters 1980 and 1981 when experimental A items were included as part of the GRE. A new revised GRE-A was instituted during the spring of 1982. Some experimental item sets were retained, some dropped, and new ones added. This, of course, may alter future conclusions regarding the GRE-A but it should not alter the theoretical assumptions underlying the GRE-A (Conrad, Trisman, & Miller, 1977). However, it is felt that enough of the experimental items and item sets were retained so that this study's findings are suggestive of what may be true in the future. Future studies of the Texas Department are planned in order to make comparisons and check the validity of our findings.

The questions of interest were tested through the use of standard multiple regression techniques. The specific regression analyses utilized are listed in the SPSS Manual (Nie et al., 1977). Correlational and descriptive data analyses were also utilized in an effort to show relationships and describe our data more completely. The regression analyses and correlations were based upon an N=48. Twenty of the original subject pool had missing data, leading to their elimination from the prediction equations. These subjects had taken an older form of the GRE which did not include the GRE-A.

Results

The first hypotheses concerns the predictive efficiency of the GRE-A when used in concert with other predictors for admission to candidacy decisions. A stepwise regression analyses utilizing twenty-three predictor variables was conducted. A multiple R of .891 for twenty-three predictors was observed ($p < .001$). This analyses yielded an overall R^2 of .794. Obviously, the twenty-three predictors accounted for a large proportion of the variance. It turned out that the first nine variables accounted for 70% of the variance, and, that these included the GRE-A. The unique contribution of each independent variable to the variance accounted for is listed in Table 1. To the extent that the GRE-A is part of the nine variables accounting for the largest portion of the known variance tends to support the major hypotheses.

Insert Table 1 about here

A more detailed inspection of Table 1 reveals four of the nine predictor variables accounting for the major portion of the variance relate to faculty ratings (total R^2Change = .538), especially Area II faculty (total R^2Change = .508). The second area accounting for a portion of the variance is the student's area of specialization (total R^2Change = .102). The remaining R^2Change accounted for by the first nine variables involves foreign student status and GRE-A (R^2Change = .057). On the other hand, it is interesting to note that in the full model GRE-V and GRE-Q in combination account for less than one-half

percent of the variance. This suggests the predictive efficiency of GRE-V and GRE-Q for advancement to candidacy decisions is questionable when they are used in concert with other predictors, at least in this sample. In contrast the GRE-A when used in combination with other variables appears to have some utility in predicting advancement to candidacy.

A final observation of the data presented in Table 1 suggests three variable clusters: faculty ratings, demographic variables and quantitative dimensions usually used as admissions criteria. Restrictions imposed on the full regression model which reflects the three clusters follows.

Quantitative Cluster

The unique contribution of each quantitative variable to the accounted for variance in the restricted model is listed in Table 2. As can be seen, GPA accounts for the largest portion of the variance followed by GRE-A. GRE-V and GRE-Q in combination do not contribute as much to the accounted for variance as does GRE-A alone. This was also observed in the full regression model. An examination of the correlation matrix in Table 3 suggests that the Analytical and Verbal scores have a stronger relationship to each other than do the other variable combinations. This observation is similar to that reported earlier by Mowsesian and Hays (1982). It may be concluded that while the GPA in this restricted model is the most efficient predictor of advancement to candidacy the GRE-A when used in combination with GRE-V also can be useful as an additional predictor. The GRE-V and GRE-Q appear to be quite independent from the advancement to candidacy decision. Nevertheless, caution needs to be repeated here. The GRE-A used in this study was derived from an experimental test. A revised test

was instituted in October 1981 and now includes analytical reasoning and logical reasoning item sets (GRE Newsletter #34, April 1981). Analysis of explanations and logical diagrams item sets have been deleted due to short-term practice and test-familiarization effects. It could be that the revised GRE-A will have a stronger predictive efficiency than is currently observed. Also, it might be speculated that since advancement to Ph.D. candidacy procedures involve higher order verbalizations on the candidate's part, the GRE-A and verbal measures will show a stronger relationship.

Insert Tables 2 and 3 about here

A unique question related to the usefulness of the GRE Aptitude Test is its predictive efficiency for advancement to candidacy. This may be especially important when attempting to consider both within institution and between institution questions. Since Ph.D. students, especially in a large institution, typically come from a wide variety of undergraduate programs their only common data may be their GRE scores. Therefore, the GRE Aptitude Test could be used as a common criterion for both within and between institution studies similar to this one. For this reason, a subsequent analyses using GRE scores both in an hierarchical and stepwise order was conducted. These data are reported in Table 4. In both analyses the combination of the three GRE scores account for slightly more than nine percent of the variance in predicting advancement to candidacy decisions. When the order for inclusion in the equation is hierarchical the GRE-V appears to be the most efficient

predictor. In neither analyses are the variables' R^2Change significant, though the GRE-A approaches significance (P=.076) in the stepwise analyses. Overall it seems that the GRE Aptitude Tests in isolation are not the most efficient predictors of advancement to candidacy decision, however, the GRE-A in combination with the GRE-V again appear to show promise.

Insert Table 4 about here

Demographic Cluster

The full regression model reported in Table 1 suggested a demographic factor contributing to our prediction. Subsequently a restricted model using only demographic data as independent variables was analyzed. The results of this analysis are summarized in Table 5.

Insert Table 5 about here

The multiple R for the ten predictors was .700 ($p < .002$) with the R^2 being .490 . The combination of the first five variables account for more than 42% of the variance. It is difficult to perceive a communality among these factors except that collectively they comprise the largest group of students. It should be noted that Area II and Counseling Psychology are essentially verbally oriented areas, with Area III being essentially quantitative. It may be that the foreign student status variable is causing the overrepresentation of Area III student, since most foreign student are in Area III. Most students

in this program are Anglo (79.4%), foreign students comprise 8.8%, with Black and Hispanic totaling 11.8%. The large majority of Anglo and non-anglo students are in verbally-oriented areas. The mixed results suggest difficulty in interpreting these findings without a more detailed inspection of the data.

Faculty Rating Cluster

Since faculty ratings are a critical part of evaluation for Ph.D. candidacy and since they form a significant part of the prediction as reported in our full model (Table 1), a third restriction on our full model was imposed. The stepwise analyses of the three-component faculty ratings is reported in Table 6. The multiple R was .731 ($p < .001$) with the total R^2 being .534 . Almost 51% of the variance is accounted for by the three Area II faculty evaluations. The remaining accounted for variance results from the rest of the faculty. It should be noted here that for administrative purposes all faculty are identified as belonging to one of the three academic areas even though their teaching responsibilities lie in the professionally-oriented areas. This results in the largest number of faculty being in Area II. Such a skewness of faculty identification may strongly influence the R^2 Change noted in Table 2. Regardless, for this sample the effect of Area II ratings in all three areas certainly effect the prediction of advancement to candidacy.

Insert Table 6 about here

The effect of more Area II faculty and their impact on GSC action is further demonstrated in the correlations presented in Table 7. The

relationship of their ratings to the remaining faculty regardless of area or ratings are in closer relationship than are the other two groups. Area II faculty do have an important influence on GSC action and based upon their ratings we can predict what GSC action will be with a high degree of confidence.

Insert Table 7 about here

Our second area of concern related to the GRE-A's predictive efficiency with regard to area of specialization and demographic data. Referring back to our full model (Table 1) we see that overall GRE-A does emerge as a more efficient predictor than some of the variables of concern. However, there is a mixed and inconclusive result bearing on this issue. At best we can say that the GRE-A when used in combination with student's area of specialization (Area II and III) and ethnicity (foreign vs. non-foreign) contributes to the overall prediction of advancement to Ph.D. candidacy.

Earlier it was noted the GRE-A scores had a stronger relationship to GRE-V scores when used in combination than did the two traditional V & Q scores to each other. This poses a question when one attempts to make advancement to candidacy decisions, or when attempting to compare decision making within and between institutions. What combination of scores will yield the best possible information when only GRE Aptitude data is used? It would appear from the data presented in Table 3 that the A score would be appropriately paired with V for such decision making. This assumes one wishes to use at least two of the

three scores (traditionally the paired combination has been V and Q) for prediction as well as the source of the most information. However, from the data presented in Table 4 the most efficient paired combination appears to be A and V. The paired combinations for the two scores accounting for the largest variance by each set of raters on each of the three evaluation criteria used in advancement to candidacy decisions are reported in Table 8. These data are reported both in terms of a hierarchical analyses (V, Q, A order) and stepwise. This is done since traditionally, in discussions of subtests of the GRE the V, Q order is specified. With the addition of A one may assume future hierarchical ordering will be V, Q, A. Examination of the V,QA combinations presented in Table 8 suggests that A in combination with V (6 of 20) and Q (6 of 20) are about equally distributed. Area III RP and folder ratings are the only consistent exception. However, for Oral ratings, regardless of which analyses or which faculty group is under consideration, the GRE-A is paired equally with V and Q. Apparently the item sets which are combined to make up the experimental GRE-A are, in general, equally weighted on the V and Q dimension.

Insert Table 8 about here

Conclusions

The hypotheses posed in this investigation were not supported to the extent expected. To the extent the GRE-A is used in combination with other predictor variables the hypotheses were affirmed. This fact gives some reason to be optimistic that the revised GRE-A subtest will yield usable data for decisions affecting advancement to Ph.D.

candidacy in a multifaceted educational psychology department. One thing which emerges is that such candidacy decisions do have a 'verbal" component which the current GRE-A includes, along with other factors not represented in the twenty-three predictor variables used in this study. With the inclusion of analytical and logical reasoning item sets in the revised GRE-A we may be getting closer to those areas important in determining readiness for Ph.D. candidacy. Two of the three evaluative criteria in the Texas Department are heavily invested in analytical and logical reasoning (R.P. and Oral). The inclusion of analysis of explanations and logical diagrams, omitted in the revised GRE-A, may be contributing to the mixed results in this investigation.

It would seem that precision of decision making and prediction of successful candidacy can be enhanced with the addition of this new component of the GRE Aptitude Test. Verbal fluency and quantitative skill mastery are certainly important prerequisites for admission to Ph.D. candidacy in a research oriented department. However, in and of themselves they appear not to be sufficient. From one point of view, completion of a Ph.D. degree is more than skill mastery. It requires independent thinking, analytical reasoning, and a degree of creativity in addition to a strong knowledge and skill base. It would seem that the GRE-A does tap these domains beyond the usually assumed areas of skill and knowledge mastery. The revised GRE-A promises to get at these factors with more precision. Subsequent investigations will be needed to assess the merit of this assumption.

It should be recognized that in no way has this study attempted or presumed to predict graduation from a Ph.D. program of study. This

was not our intent. However, in times of austere budgets, limited resources, lack of program expansion, and pressures from more and more applicants to Ph.D. programs it does seem important to make the best and most informed admission decisions possible. Also, in the current social climate it behooves those of us who are involved in student-selection to reduce ambiguities in our decision-making insofar as possible. The addition of the GRE-A to the GRE Aptitude Test may be a move in the direction of more precision in our decision-making.

Finally, although this study does not firmly establish the predictive efficiency of the experimental GRE-A in prediction of factors leading to advancement to Ph.D. candidacy, it does do two things. First, it affords sufficient evidence regarding the utility of the GRE-A as a predictive measure to warrent our continue using this score in combination with our usual predictive variables. Second, reporting these results are in keeping with the GRE Board Research Committee's recommendations with regard to institutional studies of the GRE Aptitude Tests (Willingham, 1976). Questions concerning validity, methodological issues, success criteria, among others, will be addressed as more studies similar to this one are undertaken and reported. Only then will we perhaps move toward improved evaluation guidelines from which everyone benefits.

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Table 1

Stepwise Regression Analyses

R^2, R^2Change, p Values for Each Independent Variable by Order of Contribution to Prediction for Advancement to Candidacy (Full Model)

Independent Variables	R^2	R^2Change	p
Area II - Oral Rating	.335	.335	<.001
Area II - R.P.	.448	.113	.004
Area II - Folder	.508	.060	.025
Area II Student	.540	.032	.089
Foreign Student	.574	.034	.076
Area III - R.P.	.064	.030	.086
Counseling Psychology Student	.653	.049	.022
Area III Student	.674	.021	.122
GRE - A	.697	.024	.094
Area III - Oral	.710	.013	.201
Age	.724	.013	.193
Area I - Oral	.737	.013	.197
Sex	.751	.014	.178
Area III - Folder	.758	.007	.324
GPA	.765	.007	.344
White Student	.773	.008	.312
School Psychology Student	.777	.004	.458
Area I Student	.788	.011	.227
GRE-Q	.791	.003	.510
Area I - Folder	.792	.001	.776
Area I - R.F.	.793	.001	.715
Marital Status	.794	.001	.732
GRE-V	.794	.001	.876

Table 2

Stepwise Regression Analyses

R^2, R^2Change, p Values for GRE and GPA by Order of Contribution to Prediction for Advancement to Candidacy

Independent Variables	R^2	R^2Change	p
GPA	.193	.193	.002
GRE-A	.225	.032	.180
GRE-Q	.237	.013	.396
GRE-V	.241	.004	.654

Table 3

Correlation of Independent Variables

	GPA	V	Q	A
GPA	---	.20	.05	.19
V		---	.14	.60*
Q			---	.21
A				---
$\bar{X}$	3.52	588.54	583.75	589.38
SD	.39	101.58	83.04	106.43

N = 48

* $p < .01$

Table 4

Regression Analyses

R^2, R^2 Change, p Values for GRE (Hierarchical and Stepwise) by Order of Contribution to Prediction for Advancement to Candidacy

Independent Variables	R^2	R^2 Change	p
Hierarchical			
GRE-V	.058	.058	.467
GRE-Q	.076	.018	.431
GRE-A	.092	.015	.394
Stepwise			
GRE-A	.067	.067	.076
GRE-Q	.080	.014	.420
GRE-V	.092	.011	.467

Table 5

Stepwise Regression Analyses

R^2, R^2Change, p Values for Demographic Variables by Order of Contribution to Prediction for Advancement to Candidacy

Independent Variables	R^2	R^2Change	p
Area II Student	.192	.192	.002
Area III Student	.319	.126	.006
Counseling Psychology Student	.351	.032	.148
Foreign Student	.388	.037	.112
White Student	.424	.036	.115
Age	.443	.019	.248
Sex	.462	.020	.235
Marital Status	.466	.004	.588
School Psychology Student	.471	.005	.546
Area I Student	.490	.019	.248

Table 6

Stepwise Regression Analyses*

R^2, R^2Change, p Values for Faculty Ratings by Order of Contribution to Prediction for Advancement to Candidacy

Independent Variables	R^2	R^2Change	p
Oral - Area II	.335	.335	<.001
R.P. - Area II	.448	.113	.004
Folder - Area II	.508	.060	.025
Oral - Area III	.531	.006	.466
R.P. - Area III	.525	.017	.223
Folder - Area III	.532	.001	.778
Oral - Area I	.534	.001	.734
R.P. - Area I	.534	.001	.795

*Folder Ratings - Area I drops out of Analyses, F level for inclusion insufficient for computation.

Table 7

Correlation of Ratings and GSC Action

	R.P.[1] Area			Folder[1] Area			Oral[1] Area			GSC[2] Action
	I	II	III	I	II	III	I	II	III	
R.P.										
Area I	--	44**	44**	26	17	19	52**	35**	21	28
Area II		--	48**	43**	48**	53**	49**	45**	57**	58**
Area III			--	37**	38**	43**	29*	40**	42**	48**
Folder										
Area I				--	53**	52**	59**	47**	35**	44**
Area II					--	64**	25	49**	44**	58**
Area III						--	35**	47**	47**	46**
Oral										
Area I							--	65**	32*	40**
Area II								--	54**	58**
Area III									--	50**
GSC Action										--
$\bar{X}$	7.35	7.95	7.92	9.52	9.31	10.04	8.83	8.58	8.65	2.21
SD	2.42	3.21	3.27	1.88	1.97	1.66	2.93	2.76	2.55	.54

N = 48

* $p < .05$
** $p < .01$

[1]Scaling on R.P., Folder, and Orals converted from 1 = low to 5 = high to 1 = -1 to 5+ = 15 to take into account + and - additions on ratings.

[2]GSC Action scaled 1 = high and 5 = low.

Table 8

Paired GRE Score Combinations by Order of R^2 Change for Hierarchical vs. Stepwise Regression on Dependent Variables

Dependent Variables	Hierarchical	Stepwise
R.P. Ratings		
Area I	Q,A	Q,A
Area II	V,A	A,Q
Area III	V,Q	V,Q
Folder Ratings		
Area I	V,A	A,V
Area II	V,Q	V,Q
Area III	V,Q	V,Q
Oral Exam Ratings		
Area I	A,V	A,Q
Area II	A,Q	A,Q
Area III	V,A	V,A
GSC Action	V,Q	A,Q